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EXHAUST

CAM

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OUR BIRTHDAY

THIS marks our first anniversary—we are now one year old. During the past twelve months CAM has brought a new method of maintenance training to the Canadian Army. We say new because our articles are not written in the more formal Kings' english found in standard training publications.

Instead, our technical information has been sugar-coated with cartoons—spiced with attempted humour and the slang infested language you use in every day conversation. In addition much of CAM's material is not found in the books. It's the workaday kinks and shortcuts culled from practical experience.

This has not been done to make you swallow information you don't want—we believe you like our perhaps unorthodox presentation of otherwise dry subjects. Your acceptance has substantiated this belief.

CAM has come to you for the past twelve months at no apparent cost. Anything you receive for nothing is usually of little value. Our price for this magazine then, is your interest and readership—and your contribution of ideas, articles or information which, when in print, will benefit those carrying out driving or maintenance operations.

Thousands of men and women will have received technical training before the war comes to an end. The results of the training they have received and accepted is playing its important part in the battle right now. Many of these same people will use this knowledge in their post-war work to the continued benefit of themselves and the whole community.

If CAM has contributed, in some measure, to this betterment we are amply repaid for any effort which we have put into its compilation and publication. We shall continue to give you the best material we can, prompted by your ideas and suggestions.

Contents

	Page
Synthetic Tubes	1
Voltage Regulators	5
Signal Pistols	9
The Old Refrain	10
Sludge	12
V Belts	15
Sgt. O'Sweat	16
Gas Gauges	18
Salvaging Tank Units	20
Motorcycles	Inside Back Cover

CAM is published monthly in the interests of Mechanical Maintenance, and directed to the non-commissioned officers and men of the Canadian Army.

Your contributions of articles and ideas are welcome. Address all correspondence to the Editor, CAM, Directorate of Mechanical Engineering, Department of National Defence, Ottawa.

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FIG. 1. Off to a safe start . . . inspect the tube for flaws. Do this by inflating it so that it's just barely rounded out and kinks in three places when held this-a-way. Don't over look even minor injuries—they grow fast in synthetic rubber. Note the indentifying stripe.

SYNTHETIC TUBES are TICKLISH

— and the best way to assemble them is gently

CHANCES are you've never set eyes on one yet. That doesn't mean to say you won't because all the odds point to more and more synthetics as the natural rubber tubes get used up.

One of these days you'll find a synthetic tube staring you in the face and you'll want to know a few things about them in a hurry—especially the basic things, like how to put them in tires.

Before you decide you know all there is to know about mounting a tube inside a tire we'll point out that this isn't a lesson in tube mounting. This is simply to point out the **extra** precautions and care synthetic tubes can't get along without.

If the tube in that new tire (or that replacement) has a coloured stripe running around its inner circle, the tube is **synthetic.** That stripe, whatever its colour happens to be, could very well mean danger—stop, look and listen before mounting. Synthetic's queer. While it may do the same job as crude or natural rubber and may even look the same it's tempermental as hell.

One big reason for this is that it isn't really rubber at all. It's a plastic that comes as close as possible to the natural product. In some ways it's better than the real McCoy—in others it's not as good. That's why, like a new baby, it'll take special handling. No slip shod mountings—or baby will cry and cry loud, bust a lung and need doctoring. You wouldn't want that to happen, would you, Daddy?

Synthetic rubber hasn't got the stretch quality of natural rubber. The natural stuff will stretch five to seven times its normal length and snap back again, with no harm done. Synthetic won't. It'll come back part way—but like Pte. Halftrack, who had a flat iron dropped on his head while he was in the teething stage—it never recovers its original shape.

Synthetic tubes have a grain running one way—like a piece of wood.

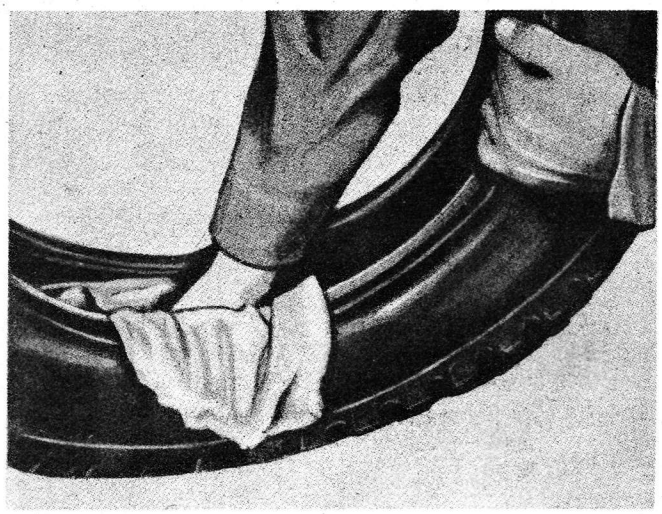

FIG. 2. "Cleanliness is next to gawdliness" so wipe the tire's innards clean. There's not much tear resistance to synthetic—abrasive particles will cause injuries that won't stop once they get started.

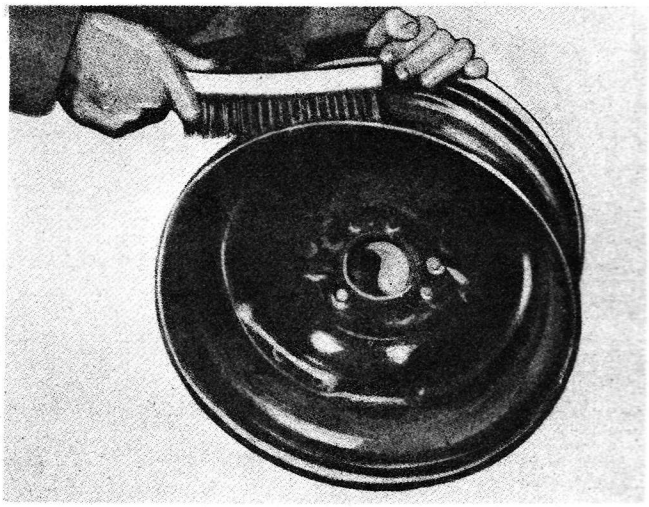

FIG. 3. Clean the rim for the same reasons you cleaned the tire. Use a stiff wire brush or anything that will scrape off rust and shine the rim. A handful of gravel will do the trick in an emergency.

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FIG. 4. Lubricate the inside of the tire beads using the talc (soapstone—90234)—or the soap and water solution. If you're using a bead lock, don't slop the stuff on the outside of the tire beads.

FIG. 5. Treat the base or well of the rim and bead seats of the rim in the same manner. Skip this operation if you're using a bead lock—you don't want slippage between the tire beads and the rim—instead, lube the bead lock on the side touching the tube.

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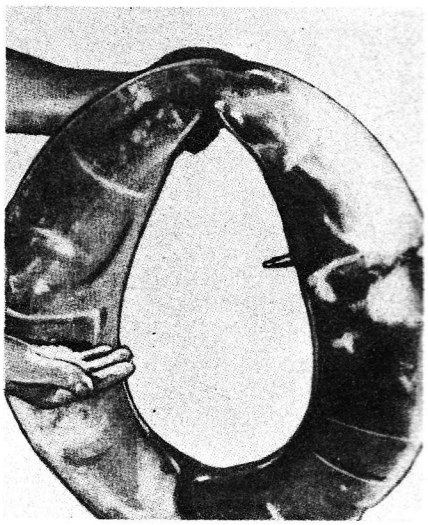

FIG. 6. You can slop all over—like a warm bottle of beer—when you lubricate the tube. The entire surface should get a good coating. This prevents the tube from sticking to the tire and causing strain on any one portion when it's inflated.

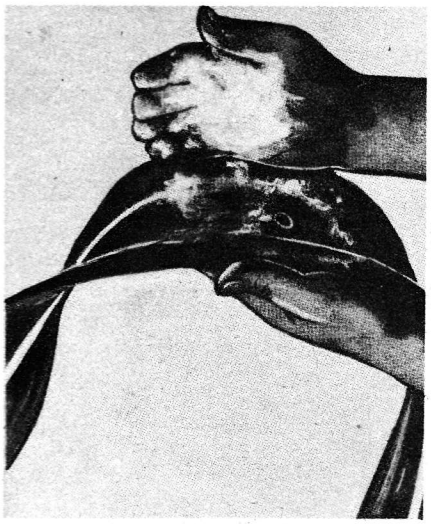

FIG. 7.—A heavy duty tube and a flat base rim will require a flap unless you're using a bead lock. Lubricate the flap on both sides if it's synthetic (see the coloured stripe.) If it's natural rubber lube only the side of the flap that will touch the tube.

FIG. 8. The flap can be inserted easier if you inflate the tube—just barely rounded out—once it's mounted. (The big tube was deflated and folded to simplify mounting.) (Note to photographer — Hey shutter-bug, what digit do with that thumb?)

FIG. 9. Check the flap insertion by running your hand between the flap and the tire to make sure that the edges have not folded over or are wrinkled. Mount the tire and finish inflating the tube. Then deflate and inflate to relieve any possible strained spots.

This means they will tear very easily. Because they do, synthetic tubes have to be free from all stress and strain before mounting and inflating for operation. Since all stress and strain means **all** — dust, dirt and other abrasive particles which might chafe an inflated tube must be ruthlessly removed. That goes for the tire as well as the rim. While the inside of the tire need only be wiped thoroughly with a clean dry cloth, the rim will take a good stiff cleaning with a wire brush to remove rust and grit.

Now that everything's as clean as a whistle, mark I, inflate the tube with just enough air to round it out. If you put too much in and it bulbs out—yo' got trouble. Like we just said, the tube never goes back to its normal shape. Wrinkles will form and premature old age and trouble will creep up on you hand in hand—fast.

So just enough pressure to round it out. It should bend in three places when draped over your hands—at each hand and at the bottom.

Inspect it carefully for injuries. Your tube might have the one flaw in a million. Even partial injuries should be repaired. This is **synthetic** remember; and mountains out of mole hills grow. What's more they'll keep growing unless repaired right—but that's a separate story.

LUBRICATION

Lubrication, as applied to rubber, is something you shouldn't overlook—it's important. Synthetic rubber tubes will **not** slide into position as easily as natural rubber during inflation. Some parts of the tube will stick stubbornly to the tire, causing stretch strain on the parts that don't stick, **unless** you lubricate the entire surface of the tube and prevent this partial sticking. Just the lube to do this job is talc (Soapstone—Spare parts number 90234) Slick up the **rim** and the **tire beads** with this same lubricant. **Never use petroleum products or oil for lubrication of rubber**—not even castor oil.

If, for some odd reason, soapstone isn't available don't pass up the lube job—use the next best thing which is a heavy solution of vegetable oil soap and water. 5 parts soap—95 parts water.

A point in this connection is when you're using a bead lock, be careful not to lubricate the base or outside of the tire beads—and don't lubricate the rim. The bead lock itself should be lubed only on the side next to the tube. This precaution helps avoid slippage between the tire beads and the rim.

When you've finished messing around with your soapstone, you can go ahead and assemble the tire and tube. On vehicles using drop centre rims there's an important thing to watch out for at this stage—and that's to get the beads properly seated as quickly as possible. Fig. 10 shows what happens to the tube when it is inflated with the beads in the well of the rim. The inside of the tube gets strained and stretched

with unhappy results. Put the air in slowly and work the beads out to their proper position (as shown by the mounting rib) by flexing the tire. On light wheels bouncing will do the trick—heavier jobs will call for a spot of judicious hammering with the rubber mallet.

Although the tube's inflated now and the whole assembly has been well lubricated, you **still** can't be **sure** that the tube is properly seated in the well of the rim and is free from undue strain inside the tire. So to make this a perfect job and avoid pinching the tube, **deflate** again to eliminate any unseen wrinkles, creases or strain and then **reinflate** to the proper operating pressure.

FLAPS

A heavy duty tube on a flat base rim will call for a tire flap. Either natural rubber or synthetic rubber flaps can be used with synthetic tubes. The synthetic flap (you'll recognize it by the indentifying coloured stripe running around its centre) must be lubricated on **both** sides. The natural rubber only on the side in contact with the tube. Be sure to smooth out all wrinkles in the flap when centering it betwen the tire beads, and be certain that the edges aren't folded over. Check by running your hand between the flap and the casing.

Then to be sure there's none of that undue strain, **deflate** and **reinflate.** That should take care of mounting the assembly. That should take care of your hand, too, if you've left it in there.

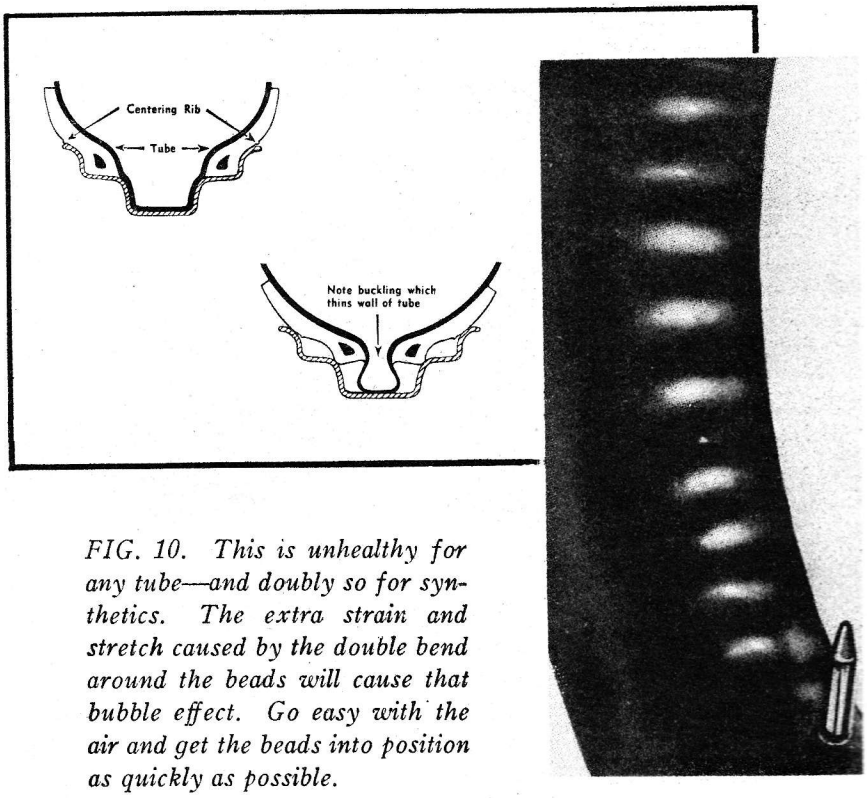

FIG. 10. This is unhealthy for any tube—and doubly so for synthetics. The extra strain and stretch caused by the double bend around the beads will cause that bubble effect. Go easy with the air and get the beads into position as quickly as possible.

Puncture repair, as we said, is another story. So far as synthetics are concerned it's strictly a higher echelon job at the moment—where they have the necessary equipment to deal with these synthetics — which, of course makes you very unhappy.

Ordinary methods of cold or hot patching synthetic tubes is not a good idea. Only under extreme emergency take on the job of cold patching—then count on it not working. It might get you home but the tube should be turned in immediately for proper repair treatment.

From what we can find out, the master minds are working hard on various procedures for repairing these tubes that will give uniformly good results.

That's the funny part about Synthetic rubber — temperamental as hell.

However in the near future we'll come across with a procedure for repair that will answer some of the workshop's synthetic questions.

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The ARMOURER

An Armourer's life may sound very fine
Attached to a Regiment of the Line,
But little is known of the poor devil's job
When he is attached to an Infantry mob.

Many a task he has got to perform,
An Electric Iron that fails to get warm
Is taken to bits by the Small Arms "Tiffy"
Who has it fixed up in half a jiffy.

He'll inspect a Machine Gun and file off the burrs—
Put a new rowel in the Adjutant's Spurs
Do any job on a Three Inch Mortar
Or mend a flat Tire for the R.S.Ms daughter.

He will clean out a Rifle with a rod and wet jute—
Or fit a new key to a B flat Flute,
The glass of a Helio doesn't reflect
It's taken to "Tiffy" for him to inspect.

He'll solder a Hat Badge, paint the Tin Hats,
Construct a Machine for catching rats,
Grind up some Scissors, or sharpen a Knife
Or repair a Coketin for the Colonels' wife.

And so Brother Corpsmen (or he who supposes)
That an Armourer's life is a mere bed of roses
A "Jack of all Trades" he must certainly be—
Although worse luck he is only "GROUP B".

Armourer Sgt. Paul
Perth Regt; C.A.M.F.

On REGULATORS

★

How to go looking for trouble on 6 volt Regulators... without sticking your neck out.

HAVE you ever been told to keep your nose out of the voltage regulator? Sure you have—and do you know why? Every Tom, Dick and Elmer isn't supposed to put the fix on these sensitive little jiggers for the same reason you don't fix your own watch. Like watches, voltage regulators require special tools and special skill. If you don't know **everything** there is to know about 'em you'll probably do more harm than good if you go nosing around.

Not everybody's a battery rebuilder and not everybody can rebore an engine but a good mechanic can tell when a battery is haywire or when an engine needs reboring. I wonder how many of these same mechanics can spot trouble in the voltage regulator —can you? You should be able to because a heap of trouble can be caused to the generator, battery, ignition system and everything else that's electrically operated if the regulator is a bit out of line. Don't misunderstand us though—we're not telling you to get yourself in dutch by delving into the regulator and fixing it. All we're going to tell you is how to find out if the darn thing is doing its stuff—just like you'd check a coil or a condenser.

Before you can intelligently check the voltage regulator and charging system you've got to know a little bit about what the regulator is **supposed** to do. This isn't anything to shy away from tho' so don't go away.

The voltage regulator or as it's more correctly called—"the generator output control unit" does three jobs. Underneath that cover you aren't supposed to take off are three separate relays—the cut-out relay, the voltage control relay and the current control relay. Each one has a job to do and each one has to be in the pink of condition, if any one of them isn't in top form you're likely to have plenty of grief in other parts of the electrical system.

You know what that cut-out relay is there for—it's just a switch that disconnects the generator from the battery when the generator's not charging. It's just like the ignition switch only it's automatic. If the cut-out doesn't open when the engine stops—the battery will run down—just like it would if you left the ignition key on. If on the other hand, the cut-out doesn't close when the generator is charging, no current can get into the battery.

The job the current relay has to do is a little different, it's like the governor on your vehicle only in this case it protects the generator. The current relay cuts in when the charging current reaches a certain value. Without it the current could climb so high in the generator, the armature would burn out in a matter of minutes. In the old three brush type generator we didn't need a current relay because the third brush looked after the maximum current.

There's no trick in how the current regulator works. When the generator charging current reaches a certain value the points in the current relay open and when this happens a resistance is cut into the generator field circuit. The more current there is flowing through the field coils in the generator, the greater the generator output. When the resistance is cut in then—the current in the field coils is decreased and so is the charging current. The same thing happens when you twist the knob on your radio to reduce the volume, you turn the knob which puts resistance

into the circuit and down goes the volume.

In the current regulator though, the points don't stay open, they vibrate, so intead of decreasing the generator output—it holds it at a certain safe value.

The voltage control works just about the same as the current control relay. You've got to have it or you'll burn up the whole electrical system with high voltage. The battery and the entire electrical system will only stand so much pressure (the voltage is the pressure in electricity). If you blow too much pressure into a toy balloon, something will happen, right under your nose. If the voltage is too high in an electrical system something will also happen (under your —— if you're sitting over the battery). The voltage regulator control is what "pops off" and prevents the electrical pressure from getting out of hand. Just like a pressure relief valve in an old pump. it turns off the juice from the generator at just the right time and it does it automatically. When the voltage gets just "so high", the relay points open and a resistance is put into the field circut.

No mystery so far—is there?

The C.P.M.S. says you have to check the operation of these three units every thousand miles. You can see why this is a "must", because without the proper operation of the generator control unit you're going to have more electrical trouble than you can shake a voltmeter at. It's just as important to check this unit as it is to check the oil in the crankcase or water in the rad.

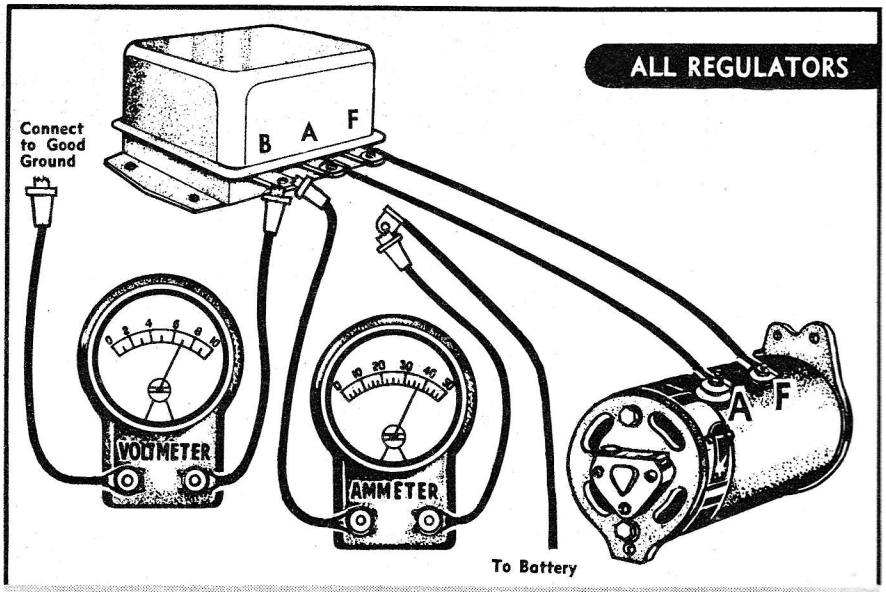

FIG. 1—Like we said—this is your "quickie check" of the charging system. You only remove one wire and connect up four clips—the meters will tell you the whole story when you start the engine. This goes for all the 6-Volt regulators you'll bump into.

All generator control units have at least three terminals. The terminals are always marked so if you look closely you can't go wrong. There's always a **battery** terminal, a **generator** armature terminal and a **field** terminal. Sometimes there's a **ground** terminal as well. The generator and field terminals are connected to the terminals of the generator. The battery terminal is where the charging current leaves the regulator and is connected to the battery. If the unit has a ground terminal it is connected to a good ground, otherwise the base of the generator acts as a gound.

We said we were going to tell you how to make a "quickie" check of the regulator so here it is.

You want to find out if the generator is charging enough—you want to find out if the current relay is holding the charging rate so it won't go too high and last but not least—you want to find out if the voltage relay is holding the voltage to a safe value.

Sorry to say—you can't use the dash ammeter or indicator because it

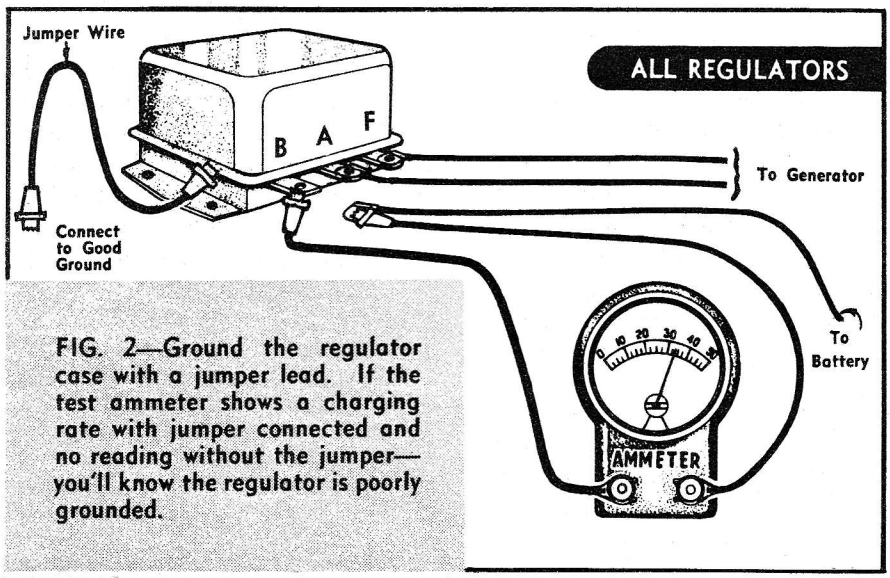

FIG. 2—Ground the regulator case with a jumper lead. If the test ammeter shows a charging rate with jumper connected and no reading without the jumper—you'll know the regulator is poorly grounded.

isn't accurate enough to rely on. You'll have to use a test ammeter and test voltmeter but they won't bite you. Step up like a man and connect up the two test meters like we show in Fig. 1.

Now that you have the meters hooked up there are a few things you have to do before you take the readings. First check the battery—if you haven't done so already. If the gravity is below 1.225 you better install another one. If the battery is up you'll have to discharge it slightly by using the starter for about 30 seconds with the ignition off, then turn on all the lights. Sounds crazy doesn't it but there's a reason. You're going to check the current regulator and while you're checking it you don't want the voltage regulator to work—that's why you discharge the battery just a little bit. OK? Now you're ready to start your infernal combustion engine, and take the readings (leave the lights on). Start it up and run it at a speed equal to about 40 miles per hour. Keep your eye glued to the test ammeter and here's what you should see—

Jeep (Willys) .....38 to 40 amps.
G.M.C. and Chev.....32 to 34 amps.
Ford .....31 to 33 amps.
Chrysler Products .....33 to 35 amps.

If you get a higher or lower reading than this you can fold up your tent and turn the job over to an expert. If the reading is OK, you are ready to check the voltage relay. So—slow down the engine till you get a reading of 20 amps. on your test ammeter. Turn off all the lights and you're ready to go.

Focus your pupils on the voltmeter for a few minutes and you'll see the needle climbing. When the needle **stops** climbing, you'll know the setting of the voltage relay and it should be between 7.2 and 7.5 volts. You may have to run the engine for several minutes before the voltmeter needle stops climbing so don't get nervous—after all—you've got to put back into the battery what you took out when you discharged it. If the needle stops climbing betwen 7.2 and 7.5 volts, all is well but if you get a higher or lower reading on any 6-volt system, there's only one thing to do, report it but quick—and don't operate the vechicle until it's fixed.

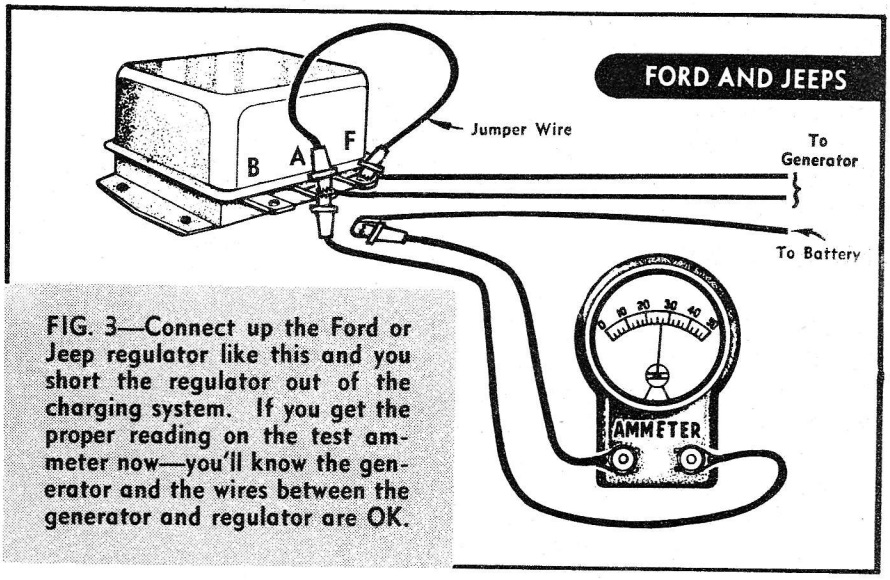

FIG. 3—Connect up the Ford or Jeep regulator like this and you short the regulator out of the charging system. If you get the proper reading on the test ammeter now—you'll know the generator and the wires between the generator and regulator are OK.

This winds up the quick check but suppose you found there was no reading on the ammeter when you made the first test. You might be the sort of a guy who wants to find out why. The trouble may not be in the regulator at all. Maybe the generator itself is dead—or may be there's poor wiring between the generator and regulator. You wouldn't want to go to the trouble of installing a new regulator if the grief was some place else, would you? Well—with a few more quick checks you can spot the trouble and still don't have to take the cover off the regulator.

POOR GROUND

The regulator has to be grounded or you won't get any charging rate so you connect a jumper wire from the ground terminal of the regulator to a **good ground.** If there's no ground terminal on the regulator—connect the jumper from the base of the regulator to ground. You still

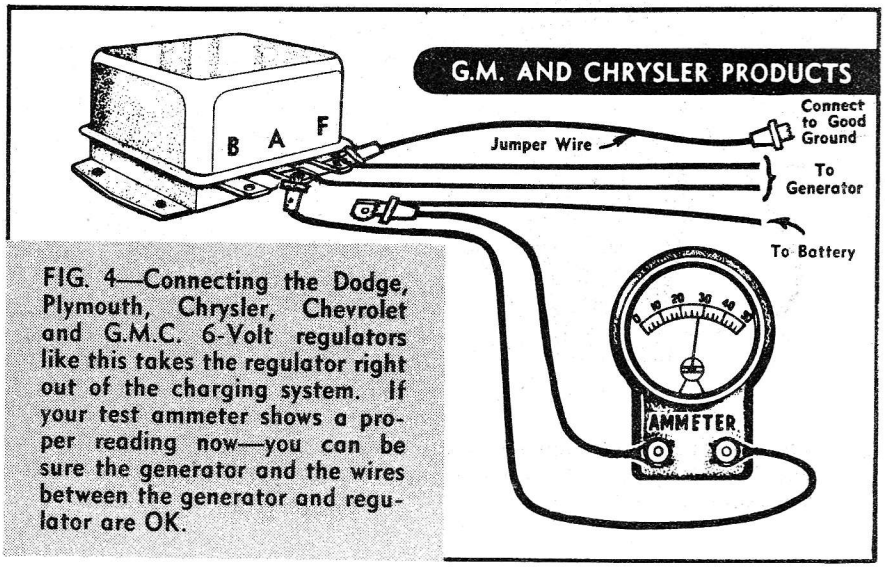

FIG. 4—Connecting the Dodge, Plymouth, Chrysler, Chevrolet and G.M.C. 6-Volt regulators like this takes the regulator right out of the charging system. If your test ammeter shows a proper reading now—you can be sure the generator and the wires between the generator and regulator are OK.

have the engine running at a speed equal to about 30 miles per hour. If the test ammeter shows a reading the moment you connect the jumper, you've found the trouble. The regulator wasn't grounded. Our Fig. 2 shows the jumper connection.

REGULATOR GRIEF

The best way to find out if the regulator is causing the trouble is to short it out. There's two kinds of regulators you'll bump into, Fords and Jeeps are one type and Chev. and Dodge are another type. Shorting out these two types are a bit different so we have shown you how to do both in Figs. 3 and 4. Connect up the jumper and test ammeter **while the engine is** still running at obut 30 miles per hour. If the test ammeter shows a charging rate as soon as you make the connections—you've located the trouble. It must be in the regulator and that calls for an exchange. When you make this test remember —the regulator is out of the circuit and you have no control over the charging rate except the engine speed. Don't run the engine too fast then, or you'll give your test ammeter the well-known hot-foot.

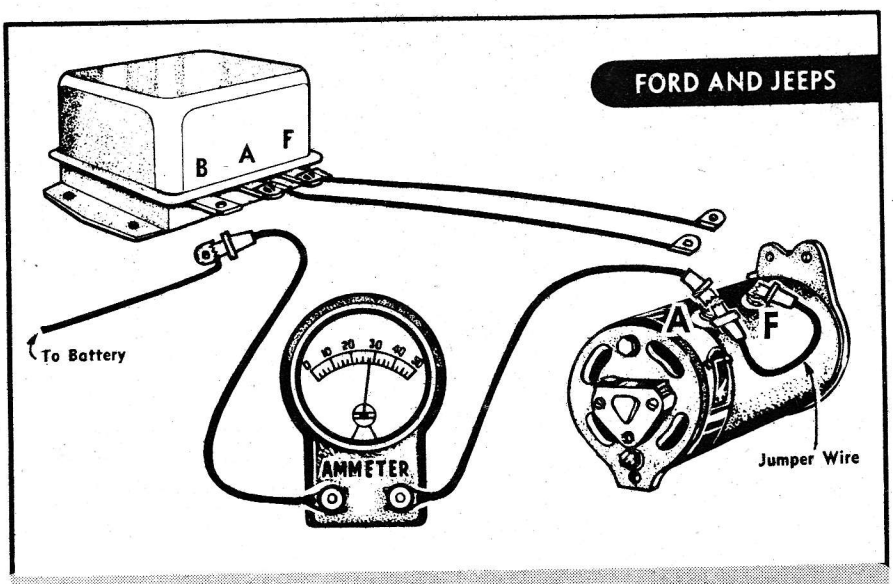

FIG. 5—Connecting the meter and jumper wire like this takes the regulator and the wiring out of the circuit. In this way you can test the generator all by its lonesome.

WIRE TROUBLE

If you haven't got **your** own "wires crossed" by this time you can check to see if the ones between the generator and regulator are. It's just a matter of eliminating them. To do this you'll have to move one ammeter clip and the jumper lead. Take a look at Figs. 5 and 6 and you'll see what we mean. The regulator is still out of the circuit so go easy with the engine speed. Connect the ammeter when the engine is **running,** like you did in the last test.

If the ammeter tells you the generator is charging now—and it wasn't charging before — you'll know the wires between the generator and regulator are broken, shorted or grounded. If the ammeter still shows a great big zero—then the trouble must be in the generator.

That's the doings. If you can make those few checks on the charging system, you'll never be stuck. A little practice is all you need and you'll be able to spot any kind of trouble in ten minutes at the most. It's worth a little bit of thinking, isn't it? Sure it is—so stick with it until you can remember the connections like you remember your regimental number.

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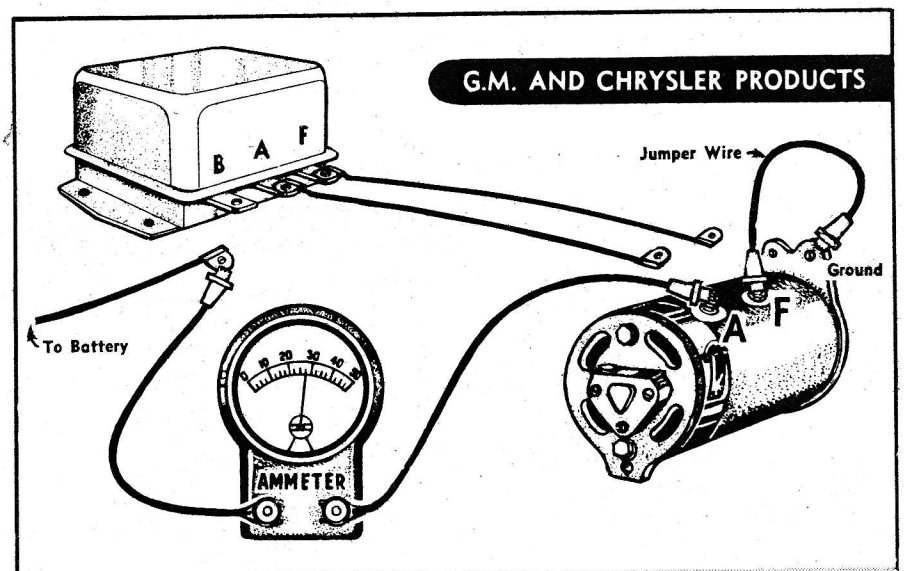


FIG. 6—This is how you test the generator only on the G.M. and Chrysler systems. By making these connections you take the regulator and the wiring out of the circuit.

ONE quiet Sunday awhile back I am sitting in a corner cleaning a signal pistol when Cpl. Kizel who is watching me, speaks up as follows:

"Why do you spend so much time keeping those signal pistols in A-1 shape when they are used so little and even then are not required to be accurate?" "It seems, "he continues, "a waste of time since they only shoot fireworks and are not dangerous."

Well, inasmuch as I am in poor health at the time, having attended the semi-annual meeting of the Bent Elbow Club the evening before, I make my answer rather sharp, in the following manner. "Look here, Kizel," I say, "for a remark like that you should be called fat head. It is because people feel the way you do that these pistols receive such misuse and are dangerous. Do you realize that the projectile from signal pistols is something to be doubly careful of because it is not only a projectile but is also burning very furiously and inclined to be a trifle warm. Because the firearm hasn't got a bullet in it most people point it at anything, whether it is loaded or not. I have never seen it happen but I imagine one of those things would burn a hole about half way through a person your size. Then, of course, you can start the grandest bush fires with the thing. Of course, the designers have given all kinds of thought to making the thing fool-proof but no one can make a thing like that damfoolproof. The flare is designed so that if fired properly it will burn itself away before it gets close enough to the ground to light any really cheery fires. The signal cartridges, that is, the red and the green should be fired almost vertically into the air and the illuminating cartridges at an angle of at least 45°."

Kizel comes out from behind the postage stamp he crawled under at the beginning of that tirade and with his eyes gleaming says, "Yes, yes, go on, you interest me strangely, don't stop now," and other bon mots too numerous to mention.

Being naturally vain and a trifle conceited this encouragement makes me continue in like vein.

Climbing onto a nearby soap box, I clear my throat and cry.

"There are of course many different models of this pistol, all except one of which are so loaded down with safety features that even you couldn't go wrong. The one exception has been made obsolete and is now being removed from service, so that leaves us in the clear. I have not time now to tell you of all these different safety features but generally speaking they are such as to prevent the pistol firing unless the cartridge is properly locked in the chamber

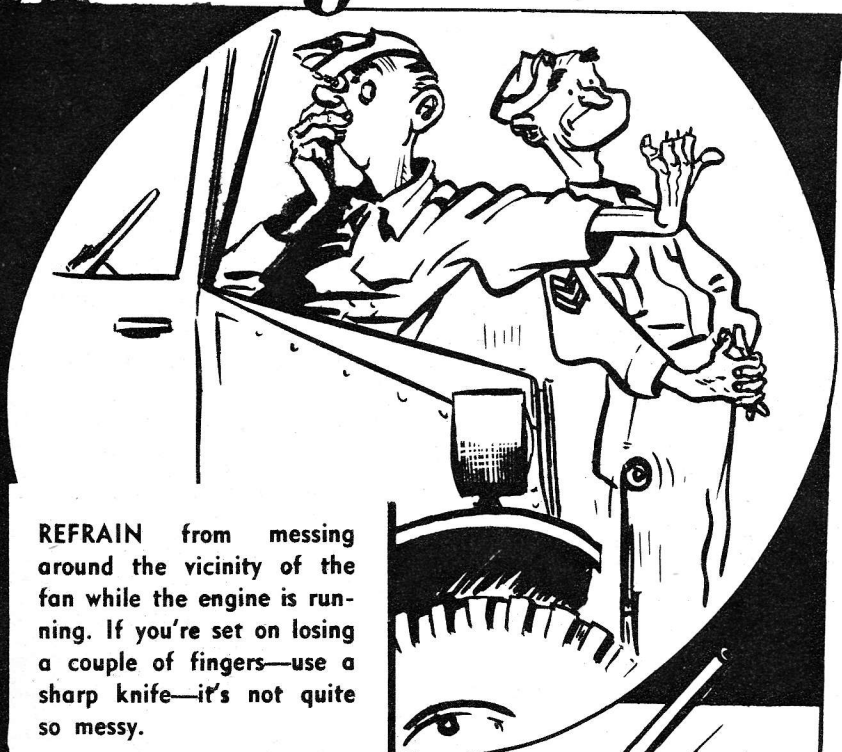
So, fat boy, if you ever hear anyone making such insane remarks as you just made, get up on your great big hind legs and tell them to pay attention to the following points: Treat a signal pistol as reverently as any other firearm, keep it clean and protect it from damage. Don't fire it at passing staff cars, and always make sure that you unload it before letting it out of your hands."

At this point Kizel steals one of my cigarettes, remembers that he doesn't smoke and puts it behind his ear to keep it moist. Then he asks, "Is it not true that signal pistols give a lot of trouble in loading and is that why you clean them in so many different ways?"

"Yes", I reply, "it is this way. Because of the methods of manufacture, the rims of signal cartridges are not held to the same close limits as other ammunition and therefore the pistols have to be made to accommodate various sizes. There is one breed of pistol that will not take some of the larger rim sizes and this, we are informed by sources close to Parliament Hill, is being remedied at the present time. In the meantime the situation will be eased if all pistols are cleaned and kept properly clean at all times. It is generally known that a solution of 8 oz. of water and 1 oz. of Oxalic Acid will dissolve the fouling from signal pistols, but this is only good for use on brass pistols as it erodes steel. Then of course, care must always be taken to wash out the acid after use with hot water and dry and oil the pistol. For steel pistols of course, other methods will have to be found. Myself, I like to use a table knife; it has no sharp points to mar the weapon and yet will scrape the fouling away very effectively."

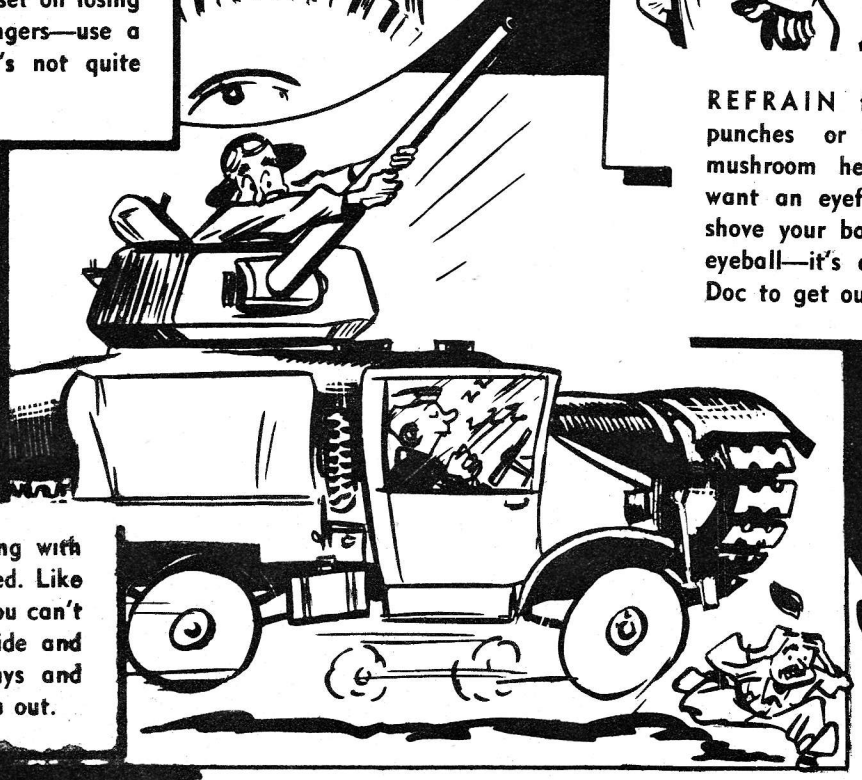
"As a final thought before you go to sleep, I might mention that even though such pistols are inconvenient to carry, they should not be thrown around and about carelessly as they **dent very readily.** Oh quit snoring!"

The Old Refrain



REFRAIN from messing around the vicinity of the fan while the engine is running. If you're set on losing a couple of fingers—use a sharp knife—it's not quite so messy.

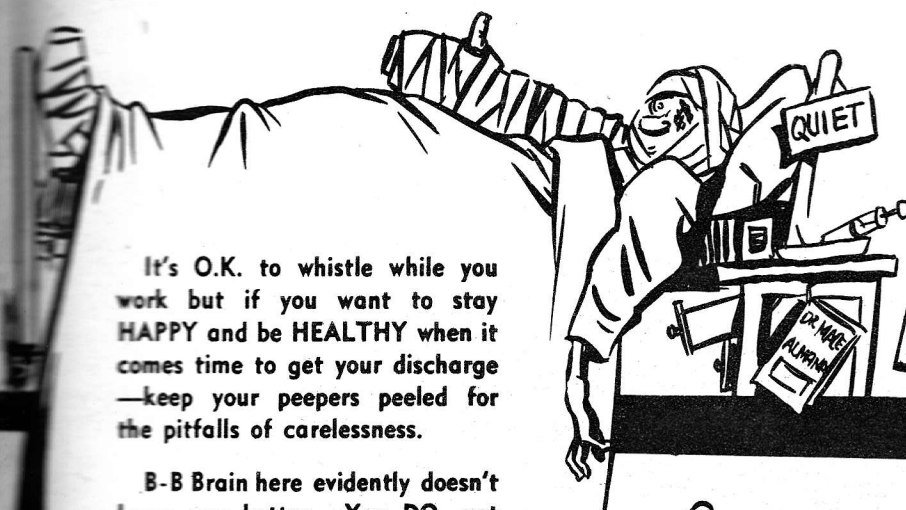
REFRAIN from using punches or chisels with mushroom heads. If you want an eyefull of steel—shove your bayonet in your eyeball—it's easier for the Doc to get out.



REFRAIN from driving with all the windows closed. Like we've said before—you can't smell carbon monoxide and there are better ways and better places to pass out.

REFRAIN from using an emery wheel unless you're wearing goggles. You may get a sparkle in your eye but after that your eye will look like a burnt hole in a blanket.

SOUR NOTES FROM THE LIFE OF... BENNY BOOB

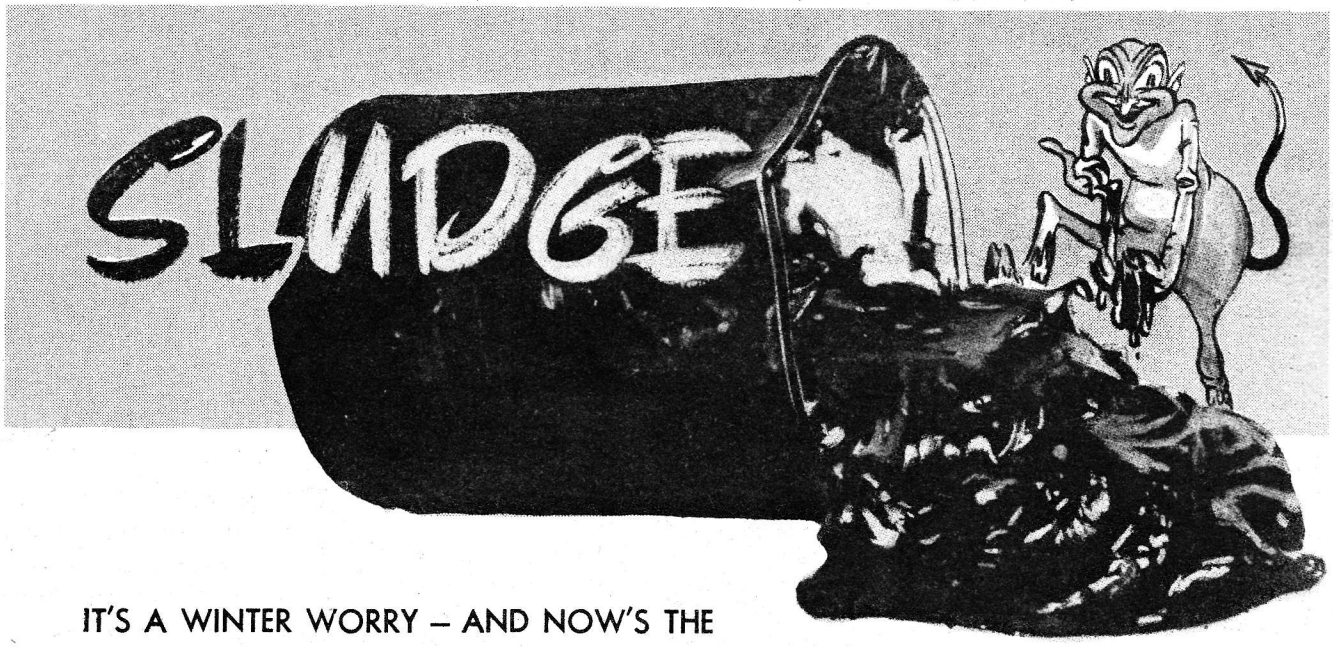


It's O.K. to whistle while you work but if you want to stay HAPPY and be HEALTHY when it comes time to get your discharge —keep your peepers peeled for the pitfalls of carelessness.

B-B Brain here evidently doesn't know any better. You DO—yet hundreds get hurt every day doing just these things. It's just like any other old refrain—we know the tune but we're apt to forget the words.

REFRAIN from driving motorcycles without wearing a proper crash helmet and make sure the strap is fastened under your chin (or chins). You may have a hard dome but think of the damage you might do to a brick wall if you hit it head first.

REFRAIN from wearing loose clothing when you're working around machinery. Can't you just picture yourself with your eyes bulging out and your neck tie being slowly wound around the automatic feed on a lathe?



IT'S A WINTER WORRY – AND NOW'S THE TIME TO GET A GRUDGE AGAINST SLUDGE

THE word even sounds dirty doesn't it? It's an unpretty name for that black or brownish-grey oozy slimy muck you find in crankcases, valve chambers and timing gear cases. It plugs up oil screens and oil filters, the acid in it often corrodes and eats into the polished metal surfaces in the engine. You've probably seen pistons and piston pins in this eaten-away condition. Since you have been using H.D. oil in your vehicle you've no doubt found less sludge—that's one of the main reasons why you switched to H.D. oil. There's still some things you can do tho' to further decrease the amount of sludge in your engine and because it does it's dirty work in the winter time you might as well know the facts now.

You want to know why it bothers you more in the winter time. You want to know a little of the background on sludge and crankcase dilution and a lot on what you can do about it in the soon to be cold future. Let's start with the principal ingredients that go to make up this filthy stuff. If we broke it down we'd find water, oil, dirt, soot, lead, iron. All that in what is supposed to be our lubricating oil. It reminds us of the song—"Who put the overalls in Mistress Murphy's chowder".

WATER—HOW COME?

Sometimes water gets into the oil because of a bad head gasket, a warped or cracked head or block, or because of loose cylinder head bolts. If you have to add water to the radiator more often than you think you should—you'd better find out where it's going and do something about it. We don't have to remind you that the cylinder head bolts should always be tightened 500 miles after a new head gasket has been installed.

Then of course there has been cases when some misinformed gentlemen filled the crankcase with H_2O and the rad with oil.

Burning gasoline in air produces water. That is not news, but did you know that for every ten gallons of fuel you burn in your engine about eleven gallons of water is produced? Gasoline is composed of hydrogen and carbon and when it burns, the hydrogen unites with the oxygen in the air to form water (H_2O). On a cold day you can see the water coming out of the exhaust in a white cloud. But not all the water goes out the exhaust—if the cylinder walls are cold (as they always are when the engine is first started) some of the steam in the hot burning gasses condenses, leaving a film of water to be swept by the piston rings. The condensation on the cylinder walls is like the condensation of your breath on the windshield on a cold morning.

Condensation also takes place on other surfaces of the engine, particularly if you run your vehicles on short errands and park them. The bitter cold cools the hot engine quickly and just like the sweat that grows on cold pipes that run through heated rooms, the little drops of water spring up all over the inner surfaces of the engine, then run down and mingle with the oil in the base. Maybe only a few drops of water get into the oil at a time, maybe only an ounce of water gets by the rings for each gallon of fuel consumed—but there it is, and more coming from the the same place.

WILL OIL AND WATER MIX?

Shake oil and water to-gether and you'll find they won't mix—not for

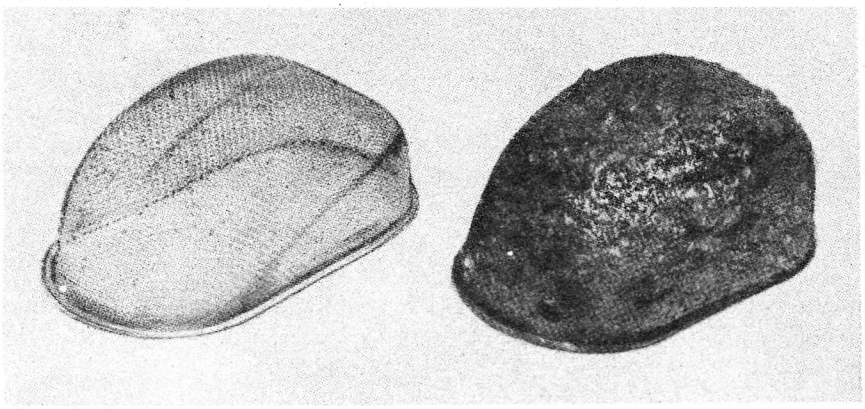
long anyway. Why then will water mix with the oil in the engine crankcase? Well let's poke our nose into Aunt Sarah's cook book and scan over the page where it tells how to make a batch of mayonnaise. It says to mix oil and vinegar. Vinegar is like water—normally it won't mix with oil. But the cook book says to mix in eggs, flour, cream and salt. These are the things that hold the mayonnaise together. No doubt there aren't any eggs etc. in the crankcase—but there is a certain amount of dirt, soot, lead and iron which does just as well in binding the water and oil together. The crankshaft is the egg-beater and does a better job of mixing than Aunt Sarah ever could—and where Aunty ends up with mayonnaise—you end up with sludge.

WHERE DOES THE DIRT COME FROM?

There's dirt in the air you breathe and the engine gets its air from the same place you do. That's why there's an air cleaner on the carburetor and the crankcase ventilator. These air cleaners don't quite catch all the dirt but they'll do an even better job if you keep 'em clean.

Soot comes from incomplete combustion of the fuel in a cold engine. As long as the choke is in use, you'll get plenty of soot.

Lead comes from the fuel too, because as you know, all of the gasoline you use in your vehicle is lead treated.



A bad case of sludge clogging shuts off oil circulation through the screen on the right. Bearings get oil-starved with disastrous results.

Iron finds its way into the crankcase in very minute particles. The natural wear that takes place in the engine shears metal off the cylinder walls and other internal parts of the engine.

Mix all this stuff with the oil in the crankcase and you have—SLUDGE.

IS SLUDGE WORTH WORRYING ABOUT?

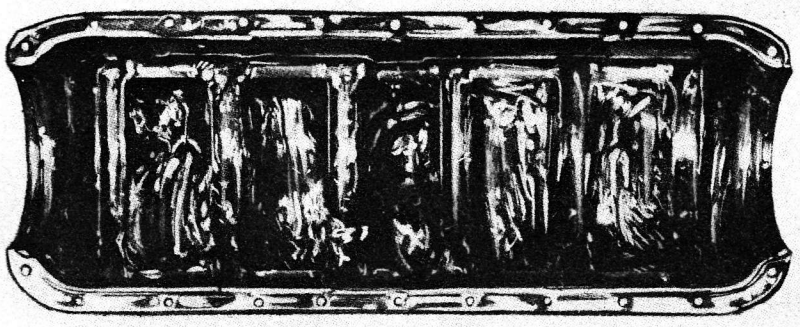
Silly question isn't it because we have already said it plugs oil screens and filters. Normally the oil filters' job is just to collect the foreign particles that float around the oil. If the oil becomes thick and mucky with sludge the oil filter clogs up in no time. Just like trying to strain mud through your hanky, it just won't go. Eventually the sludge will clog the oil screens too and prevent circulation of oil to the parts that vitally need it. We don't have to tell you what happens then.

Sludge is harmful for another reason too. Like we said it contains water — the water combines with traces of sulphur found in the fuel and you have dilute sulphuric acid. This is the stuff that causes corrosion, broken valve springs and pit marks on the highly polished metal parts.

CRANKCASE OIL DILUTION

This usually goes hand in hand with sludge and old man winter. That's the time when you have to use the choke a lot and when you use the choke you dilute the oil. Why do you have to use the choke to get started in cold weather—is that what you're wondering? Well—when gasoline leaves the carburetor it's only partly vaporized, some of the particals are large drops of liquid and won't burn. Only the fuel that's in vapour form will burn. When the engine is hot the heat will vaporize the liquid drops and all of the fuel will burn in the cylinder. (Nearly all anyway). When the engine is cold there's a shortage of usable mixture so we have to increase the gas and cut down on the air by using the choke. This will allow the engine to

Not the bath tub at the boarding house—just a well sludged crankcase pan. The picture doesn't have to be as bad as this to cause trouble in your engine.



start OK but—because the liquid drops of gasoline won't burn they roll down the sides of the cylinders and mix with the oil in the crankcase.

Under certain conditions, you are told to dilute the oil. Adding gasoline to the oil thins it out and is necessary for easy starting in extremely cold weather. When the engine warms up and is operated at normal temperatures the engine heat will evaporate the gasoline in the oil and no harm is done. If in addition to this the vehicle is over-choked or never gets a chance to operate at normal temperatures, the oil will be diluted too much and the gasoline will never evaporate. The crankcase ventilating system plays an important part in getting rid of the gasoline in the oil as it allows clean fresh air to circulate through the engine.

If the oil dilution is excessive, engine wear will result from poor lubrication.

HOW TO DECREASE SLUDGE AND DILUTION.

When you find excessive sludge or dilution in an engine you can be sure there's something wrong, either in the engine or in the way it's operated. In any case, there are a few things you should do to help prevent sludging and dilution when the weathers' cold enough to wear your melton.

The most important thing you can do is prevent condensation as much as possible. See what you think of these steps in that direction.

Don't operate your vehicle with engine temperatures below normal. Warm it up to normal operating temperature before you start out and then keep it that-a-way. When warming up a cold motor run it at a speed **above** idle, but not **too fast,** till the oil warms up. If you find the operating temperature is low, check the thermostat. You may have to partially cover the radiator as well, this helps keep cold winds from chilling the engine. Closing the hood louvers will help to keep the warm air inside.

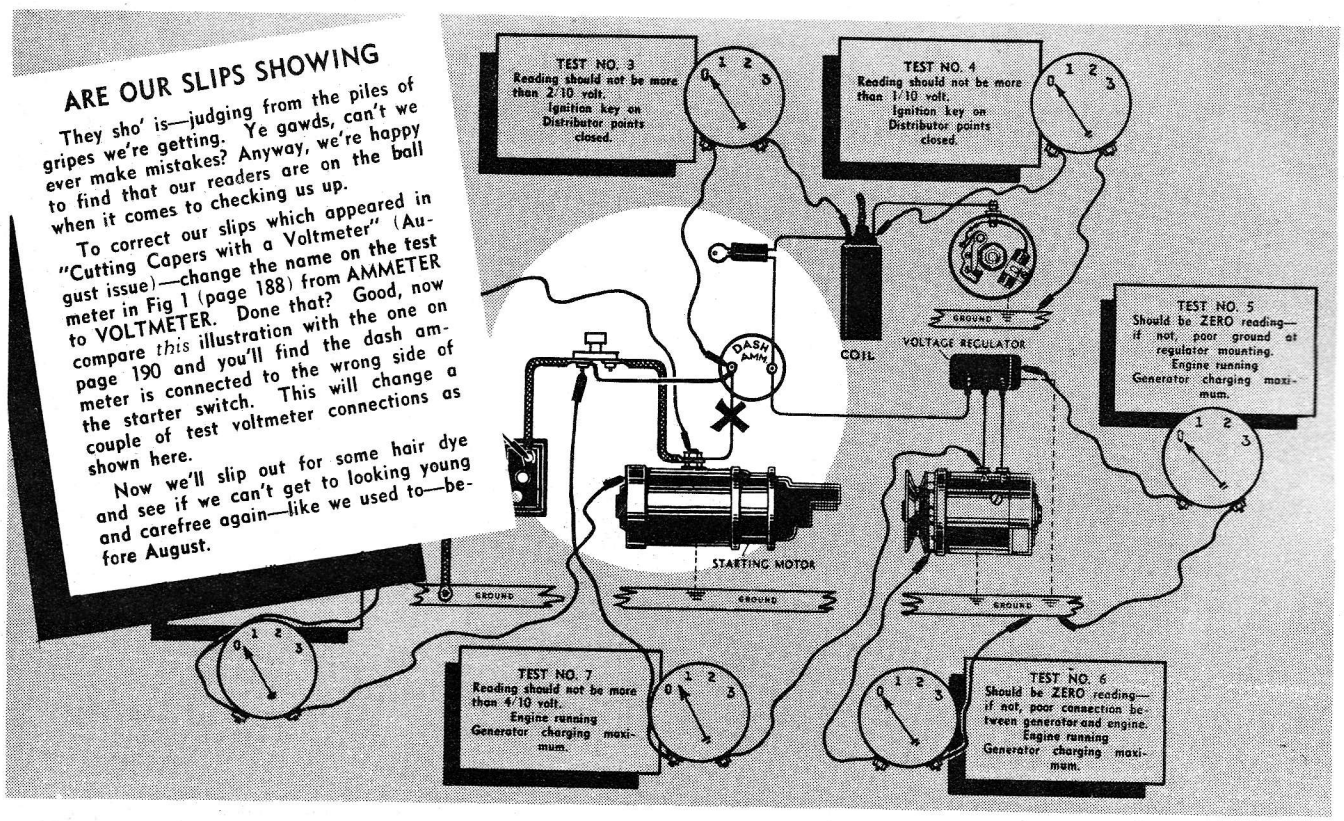
Make sure the crankcase ventilating system is not restricted by dirt. If the engine is equipped with a ventilator valve the valve should be free and the oil bath air cleaner should be clean. If the system just consists of an air cleaner and breather pipe, keep 'em free from dirt. Any restriction at any of these places will prevent air circulating through the crankcase. Therefore, whatever water or gasoline does get into the oil, doesn't have much chance to evaporate.

Oil changes may be necessary more often than usual when engines are run cold and so exposed to condensation. If you find the oil is thin and smells like gasoline—drain it, and drain it **hot,** regardless of the mileage. Draining the oil filters is important, too—that's often the first place water collects.

That about does it. For cold weather operation, get your engine warm in a hurry and keep it that way.

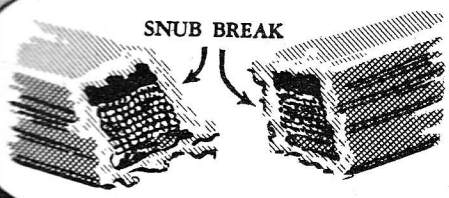
That goes for you, too.

X Y Z


ARE OUR SLIPS SHOWING
They sho' is—judging from the piles of gripes we're getting. Ye gawds, can't we ever make mistakes? Anyway, we're happy to find that our readers are on the ball when it comes to checking us up.
To correct our slips which appeared in "Cutting Capers with a Voltmeter" (August issue)—change the name on the test meter in Fig 1 (page 188) from AMMETER to VOLTMETER. Done that? Good, now compare this illustration with the one on page 190 and you'll find the dash ammeter is connected to the wrong side of the starter switch. This will change a couple of test voltmeter connections as shown here.
Now we'll slip out for some hair dye and see if we can't get to looking young and carefree again—like we used to—before August.
TEST NO. 3
Reading should not be more than 2/10 volt.
Ignition key on
Distributor points closed.
TEST NO. 4
Reading should not be more than 1/10 volt.
Ignition key on
Distributor points closed.
TEST NO. 5
Should be ZERO reading—if not, poor ground at regulator mounting.
Engine running
Generator charging maximum.
TEST NO. 7
Reading should not be more than 4/10 volt.
Engine running
Generator charging maximum.
TEST NO. 6
Should be ZERO reading—if not, poor connection between generator and engine.
Engine running
Generator charging maximum.
COIL
VOLTAGE REGULATOR
DASH AMM.
STARTING MOTOR
GROUND

Don't give your V-BELTS a BREAK

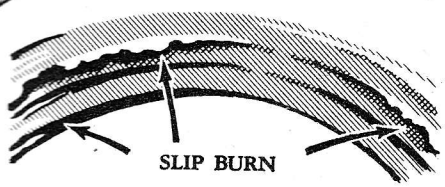
Even if they are toughies they'll go to pieces with neglect. With a little P.M. they'll give long and efficient service.



This belt, running loose, suddenly grabbed and snapped in two. Evidence of this lies in the fairly clean break and the slip marks on the side of the belt.

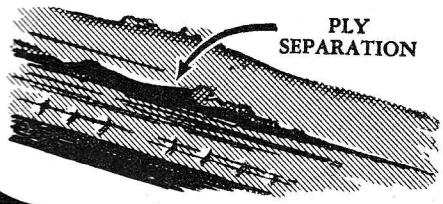
PREVENTION

Proper tension should be maintained at all times by making the necessary adjustments. One way to check on the amount a belt is slipping is to note the speed of the driven pulley without load and then under full load.



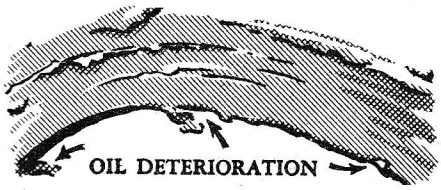
The rubber has been melted from the sides of this belt by a spinning driving sheave rotating against the motionless belt.

Check adjustments. If they are correct and the belt continues to slip, check for the presence of oil or some other lubricant. If the belt still slips, then it must be assumed that the load is too great.



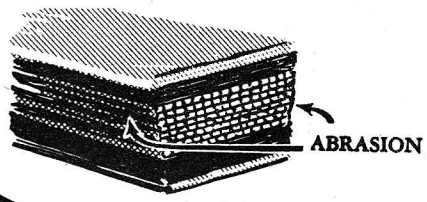
This belt was run over a sheave much too small to accommodate it. As a consequence the belt was bent too severely as it ran over the sheave. The high internal friction set up caused the breakdown of the binder rubber.

Although any V belt can be run over several sizes of pulley, there is a minimum size. If you attempt to make a certain belt run on a pulley which is too small, the excessive bending will soon ruin the belt. Choose the right size belt.



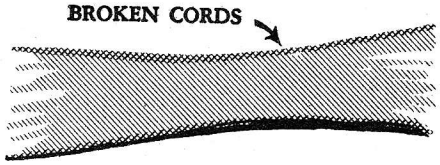
Oil and most V-belts won't work together. Some synthetic belts can withstand the action of oil, but they're the exception. Once the rubber is softened, there is no support for the internal cords and fabric.

Oil the bearings and not the belts. When lubricating a machine use only enough lubricant to do the job. Wipe off whatever excess oil or grease may leak from a bearing so that there is no possibility of damaging belts.



Abrasive dust, especially when it's mixed together with oil, will wear down the sides of the best V-belt in the world. If this wear continues the belt will become so small that it will ride in the bottom of the groove. As a rule, the sides of a V-belt are counted on to do the driving.

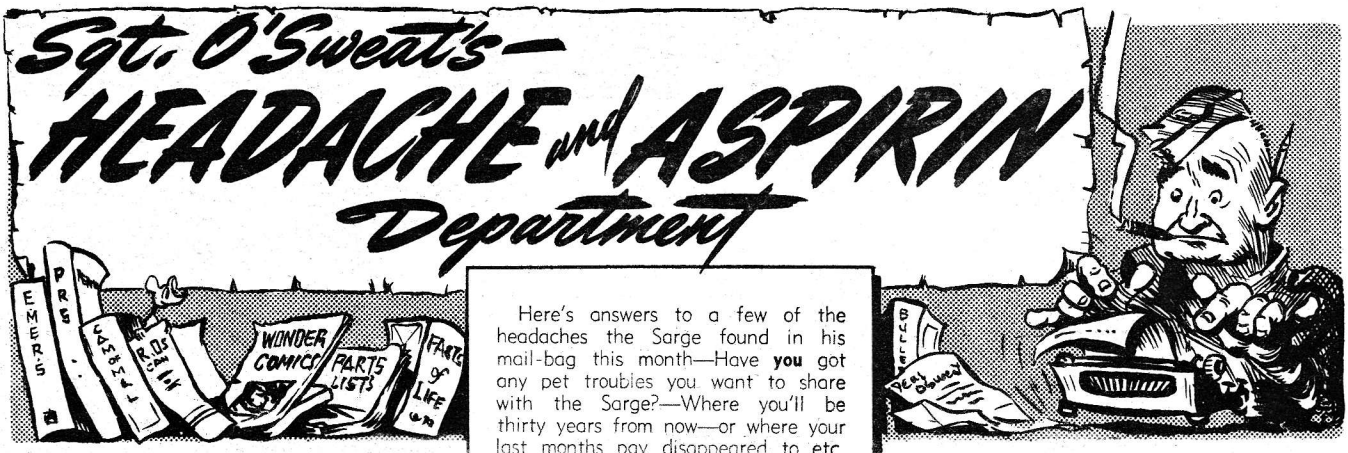
When operating in dusty surroundings, V-belts should be given protection from the abrasive action of dust particles. It is especially important to make sure that belts aren't slipping. Check tension adjustments.



Using a husky screwdriver to pry a V-belt into position without loosening the adjustments may produce results such as this. Here the internal cords of the belt have broken after just such a strain.

Every well-designed V-belt drive has a means for making adjustments. Obviously, in some tight spots, you can use the persuasion of a screwdriver, but back off the adjustments all the way before you try it.

Sgt. O'Sweat's— HEADACHE and ASPIRIN Department



Here's answers to a few of the headaches the Sarge found in his mail-bag this month—Have **you** got any pet troubles you want to share with the Sarge?—Where you'll be thirty years from now—or where your last months pay disappeared to etc. etc. Strictly speaking, he only answers personal questions on his own time but if you have any technical maintenance problems write to Sarge O'Sweat—Cam Magazine, Directorate of Mechanical Engineering, Dept. of National Defence, Ottawa.

GUM DEPOSITS

Dear O'Sweat:

Can you give the right answer as to whether gum will form more quickly in a partly full gasoline tank or a full gasoline tank?

We have been arguing the issue as to whether it is best to keep the tanks full regardless of whether both tanks are used or not.

I hope you can settle the argument by giving us a definite reason.

Pte. J. W.

Dear Pte. J. W.:

I'm going to give you a double answer to that question but I'll explain why in a minute.

If very little mileage is being put on the vehicle—as **little fuel** as possible should be kept in the tank. If the vehicle is used a lot, consequently using a great deal of fuel—you should keep the tank (or tanks) as **full** as possible.

Here's why.

Old, stale gasoline forms gum faster than fresh gasoline. Also—gum has a habit of forming if the gasoline is splashed around in the tank over a period of time and absorbs a certain amount of air.

Most army vehicles are in continual use but if you run across a vehicle that only uses two or three gallons of gasoline a week—don't fill the tank right up. By the time you'll use the whole tankfull—the gasoline will be stale.

Where you're more likely to run into trouble is on vehicles equipped with two tanks. You should keep them both as near full as possible to prevent splashing. As soon as you empty one tank—fill it up and switch to the second tank. If you alternate them neither one will ever contain stale gasoline.

OK—no more arguments and no more gum.

O'Sweat

P.S. I just happened to think—do you know what to do if you run into vehicles that have already got this gum condition? If you find any fuel pumps or carbureters gumming up so you have to clean them every week or so—the gum is most likely coming from the tank. Gum will dissolve in denatured alcohol. Instead of going to a lot of trouble, then all you have to do is add one pint of alcohol to twelve gallons of fuel. Make sure the alcohol is moisture free. One or two treatments should do the trick.

CLEANING GOGGLES

Dear O'Sweat:

Do you know of any method we could use to remove the marks on our welding goggles? The marks I am speaking of are caused by the flying sparks and ordinary cleaning is not satisfactory.

Cpl. T. E. R.

Dear Cpl. T.E.R.:

Browsing through the stack of magazines I keep handy for such questions as yours—I found the answer.

This method won't remove scratches but it will remove the particles that adhere to the glass which you can't remove by ordinary washing.

Remove the lenses from the frames and soak the glass in muriatic (hydrochloric) acid for five minutes or longer depending on how badly the glass is coated.

Now comes the important part. Before you replace the lenses in the frame—be sure to wash them off well in water.

Any fog you see after this operation—you won't be able to blame it on your goggles.

O'Sweat

RECLAIMING THERMOSTATS

Dear Sgt. O'Sweat:

We have a number of cooling system thermostats which were taken out of vehicles during the extreme heat of the summer. There are several more which are ready to be turned in for salvage. We intend sorting out the good ones from the bad and re-installing them in vehicles.

Have you any suggestions as to the best method of testing thermostats and is there any possible way of reclaiming the units that are defective? It seems such a waste to throw away these units if they can be repaired.

S/Sgt. D. MacL.

Dear Sgt. D. MacL.:

With a name like you've got—no wonder you want to be thrifty. We like to hear from people who would rather repair than replace—so here's what you want to know.

In a great many cases the cooling system thermostats can be made as good as new by giving them a good cleaning. If you find the bellows leaking however—it's usually impractical to try to repair them.

There's only one way to properly test thermostats and that is to test them under operating conditions Before testing remove all the scale and rust as that might cause them to stick open or closed.

Place the thermostat in a bucket of cold water and slowly bring the temperature up by heating the bucket with a blow torch. At the same time stir the water to ensure an even temperature. Keep your eye peeled for the thermostat to start opening G.M.C. and Chevrolet **start** to open at about 145 degrees and are fully open at 170 degrees. If you haven't got a thermometer handy, use a vehicle heat indicator. Dodge and Ford thermostats **start** to open about 160 degrees and should be fully open about 190 degrees. If you find the thermostat operates within five degrees either way of these figures you can take for granted it's OK.

Well that just about sums it up—hope you are able to save scads of 'em.

O'Sweat

BENDING TUBING

Dear O'Sweat:

I have come upon a problem that has given me a considerable amount of trouble. I am writing you, hoping you can help me out.

The problem is to bend a piece of 3/8" copper tubing or brass tubing at a small radius. For example—1/4" radius and so that the inside diameter of the tube will not be damaged.

I have tried packing the tube with sand and annealing it but don't seem to have much headway. I will appreciate any ideas you can send me on the matter.

Cfn. H. L.

Dear Cfn. H.L.:

I can see how you would have plenty of grief trying to make that sharp a bend in 3/8" brass or copper tube. It just can't be done, chum. You see there are certain limits to how sharp you can bend the stuff. The following will give you an idea of how sharp a bend can be made with copper tubing—anything less than this is impractical.

O.D. of Tube	Radius to centre of tube
3/16"	1/2"
1/4"	5/8"
5/16"	3/4"
3/8"	1"
1/2"	1-1/2"

The easiest method of bending tubing is to use a tubing bending tool. All Army Workshops and Unit Garages should be equipped with these tools.

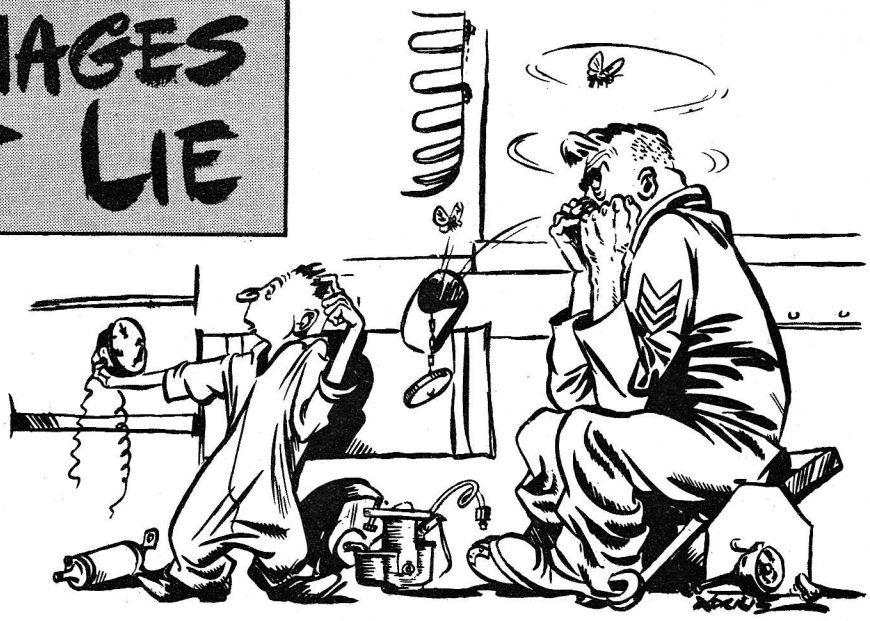
If by chance you have to do the job without the proper tool—you've got a job on your hands but it can be done. First make sure the copper or brass tubing is annealed. Next, fill the tube with dry sand and plug the ends with molten solder to keep the sand in. Now clamp the tube in a vise and heat the part you are going to bend. Don't try to do the job in a rush, heat it and bend it a little, then heat it again and bend a little more. Don't get it too hot. As you make the bend cool the outside of the curve with water. This prevents the ouside curve from stretching too much while the metal on the inside of the curve can compress when it's hot and pliable. The main thing to watch is your patience.

If you need a bend with a smaller radius—the only thing I can suggest is an elbow fitting.

O'Sweat

x y z

GAS GUAGES MUSTN'T LIE



TROUBLE in gas gauges need not be hard to locate and remedy—it's just a matter of knowing a little bit about them. If you know how they work and where to look for trouble it usually just takes a jiffy. Most of the gas gauges you'll run into on army vehicles are electrically operated and that's the kind we're going to delve into now. So put away your yo-yo for five minutes and learn all there is to know about them—they're that simple.

A diagram, showing the complete wiring of the innards of a gas gauge is shown in Fig. 1.

The current flows from the battery to the dash unit of the gauge, through small coils of very fine wire and then flows to the tank part of the gauge. Actually the dash unit is operated by two small electro-magnets, the strength of the magnets depend on the amount of current flowing through the coils of fine wire. The movement of the indicator needle is caused by the attraction of the small core (attached to the needle) to one or other of the magnets.

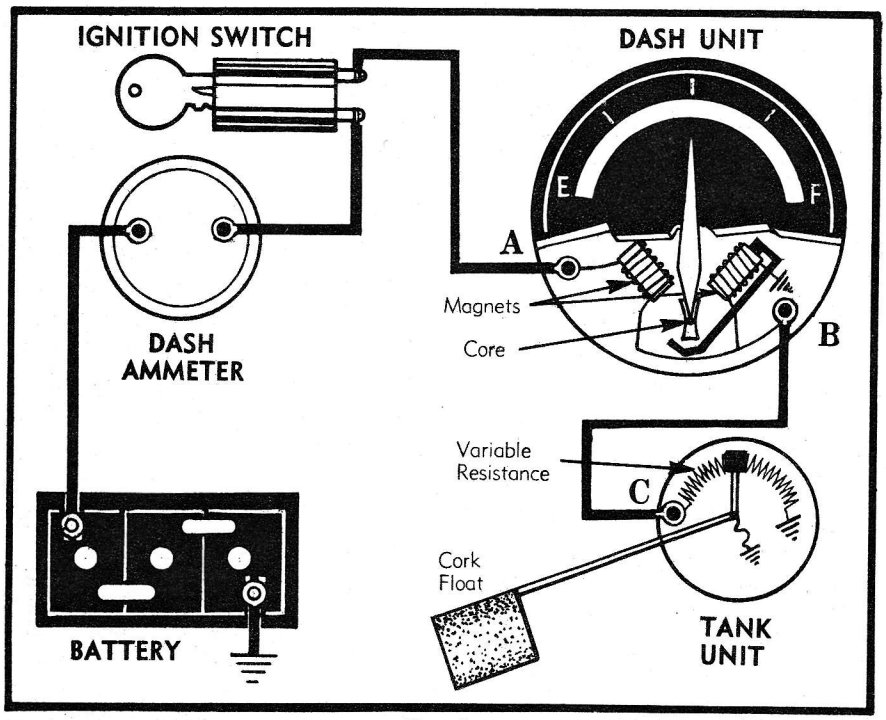


Fig. 1

As in other electrical systems, the amount of current supplied to the coils is controlled by a resistance. The resistance in this case is variable. Take a close look at the tank unit and you'll see what we mean. The resistance in the tank unit is curved, one end of it is connected to the dash unit and the other end of it is grounded. To make the resistance variable another ground connection is made through a sliding brush, connected to the cork float in the tank by an arm. As the level of the fuel raises or lowers in the tank, so does the float and the sliding brush. The brush being grounded shorts out all or part of the resistance, depending on where it's contacting the curved resistance in the tank unit. Therefore, you can see how the level of the fuel in the tank can vary the strength of the electro-magnets in the dash unit part of the gauge. To prevent the gauge from registering normal slopping of the gas in the tank, the movement of the float arm is slowed down by a friction brake.

We said before that it's an easy job to test the gas gauge and we meant every word of it—but—it's also very easy to ruin a perfectly

good gas gauge by making the wrong kind of tests. For example—here's three things that you shouldn't do unless you want to burn out the tank unit. The first is—**don't short across the two terminals on the dash unit.**

Number two—**don't connect the tank unit to the battery,** and thurreee—**don't touch a hot battery wire to the terminal marked tank on the dash unit.**

The reason for **not** doing these things is that the tank unit will only carry so much current. The resistance of the fine wire in the **dash unit coils** have to be **in** the circuit otherwise the tank unit will go up in smoke.

GAS GAUGE TROUBLE CHART

Here's a cause and cure chart that will save you a heap of time (if you can remember it). We thought perhaps some of you knucklebusters would be interested in jotting down a copy of it so you'll have it handy the next time you run across a gas gauge that's on the fritz.

Gauge Action	Cause	Remedy
Pointer will not move when ignition switch is turned on.	Lack of fuel.	Fill tank.
	Break in line or poor connection between dash unit and ignition switch.	Repair line and tighten connections.
	Defective dash unit.	Replace.
Gauge shows "Full' under all conditions.	Break in line between dash unit and tank unit.	Check line and all connections. Clean the contacts on bayonet connections.
	Tank unit burned out.	Replace tank unit.
	Tank unit improperly "grounded" due to loose mounting screws or paint under screw heads.	Tighten tank unit mounting screws. "Ground" tank to chassis and test.
Gauge shows "Empty" under all conditions.	Dash unit not "grounded".	Replace dash unit.
	Wire from dash unit to tank unit "grounded".	Inspect wiring and tank unit connections.
	Tank unit terminal "grounded".	Check to see that tank unit terminal is not touching any part of the chassis or body.
Gauge never reads "Empty" or reads too high.	Loose or dirty connections.	Check wiring connections.
	Defective dash unit.	Check dash unit. Replace if necessary.
	Defective tank unit.	Check tank unit. Replace if necessary.
Gauge never reads "Full" or reads too low.	Partial ground in wire from dash unit to tank unit.	Check wiring.
	Terminal stud on tank unit "grounded" by road dirt.	Clean all dirt from tank unit terminal stud.
	Defective dash unit.	Check dash unit. Replace if necessary.
	Defective tank unit.	Check tank unit. Replace if necessary.

DON'T EVER LUBRICATE THE DASH UNIT OR THE TANK UNIT

The best way to check the gas gauge is to use a spare tank unit, one you know is good. We suggest you draw one from spare parts and use the same one for testing purposes all the time. To make it handy, solder a ground wire and battery clip to it and attach another wire and small clip to its terminal as shown in Fig. 2 Here's the quick checks you can make—and in the proper order too.

◆ Turn ignition switch "OFF". Disconnect **tank** wire from **dash** unit at "B".

◆ Clip **small** tester clip to the "B" terminal on dash unit.

◆ Clip **large** tester clip to any clean ground.

◆ Turn ignition switch "ON". Move arm on tester up and down, dash unit should read "FULL" and "EMPTY". if it does, the trouble isn't in the dash unit so turn the ignition switch "OFF" and reconnect the tank wire at "B".

◆ If the dash unit is O.K., disconnect the wire at the terminal "C" of the tank unit, (or the bayonet connection near the tank unit.)

◆ Clip **small** tester clip **to the end of the wire** just disconnected and clip **the** large **tester** clip to any clean **ground.**

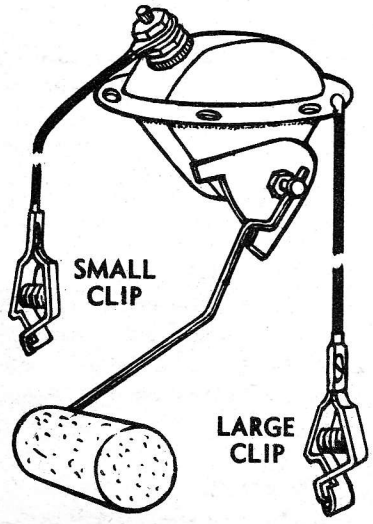


Fig. 2

◆ Turn ignition switch "ON". Move arm on tester up and down, if the dash unit still reads O.K. you'll know the trouble isn't in the wiring.

◆ If on this test you find the dash unit reads **empty** all the time or the reading is noticeably lower than was shown when you made the test right at the dash unit, look for **shorts** or **leaks** in the wiring between the dash unit and the tank unit. Leaks are most likely to occur at terminal junctions or at points where wire is fastened to the body with clips. If on the other hand the dash unit reads full all the time you're making this test or reads higher than when you tested right at the dash unit, look for **poor connections** or a **break** in the wiring.

◆ If after making the above tests you still haven't found the fault you can assume the trouble must be in the tank unit. **Remove** the tank unit (drop the tank if necessary) and clean off all the dirt that has collected around the terminal, particularly calcium chloride (see CAM, May 44, page 127—Ed.) Any electrical leak at this terminal through dirt or corrosion is apt to cause an inaccurate gauge reading.

◆ After cleaning reconnect the wiring, (gauge still out of tank) turn ignition switch "ON" and after properly grounding the tank unit, see if the dash unit reads as it should when you move the cork float up and down.

◆ If this last operation still hasn't corrected the trouble install another tank unit. Make sure you check the new unit tho' before you install it because you might just be the unlucky guy to draw a dud.

Well there you have it—now you should know as much about it as we do. Although it's not a good idea to try repairing the innards of the dash unit—the tank unit often lends itself to repair by a salvage-minded soldier who is hep to a spot of fine soldering. Throw an eye over the next column for the lowdown.

x y z

Salvaging Tank Units

Gasoline gauge tank units are the part of the gas gauge that is most likely to give trouble. The reason for this is because it's subject to a lot of wear and tear. If you've read the article on gas gauges you'll know what's inside the tank unit. You can see that the fine coil of resistance wire is rubbed by the sliding contact everytime the tank is filled or emptied. Another thing—(and it often happens)—the dash unit gets shorted out. This causes full battery current to flow through the fine coil in the tank unit. In about 1/4 of 1/10 of a second—the resistance coil is burned out.

Then what?

You can replace it with a new tank unit and that's what is usually done or—and it's not much of a trick—you can repair it. These tank units are worth while salvaging at four or five bucks apiece.

If you have a soldering iron and your fingers aren't all thumbs —here's what you do.

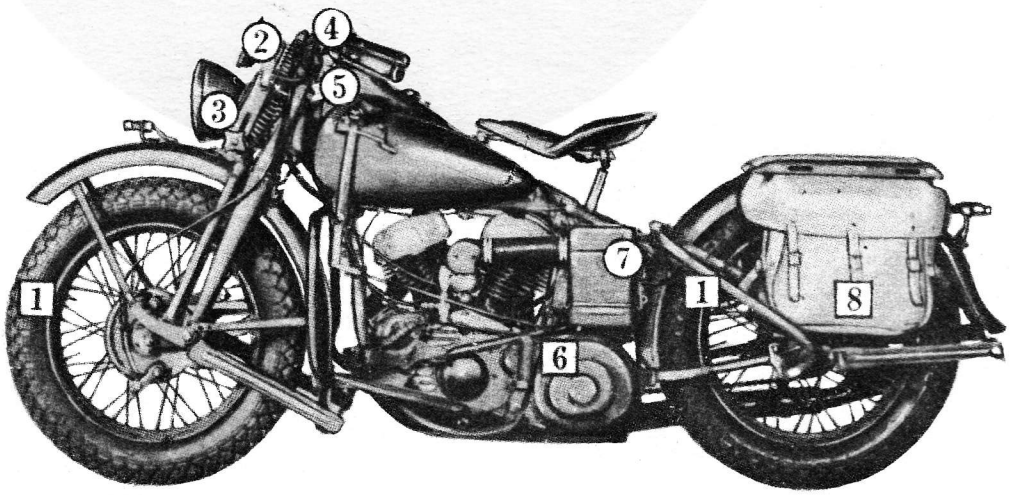
Grind off and punch out the rivets. Now you can remove the resistance coil. Very carefuly unwrap one turn of fine wire where it is broken or burned out and you'll have enough wire to tie together. A drop of solder on the joint you made will make it permanant. Don't use acid core solder—like soldering on all other electrical wiring you've got to use a rosin flux. Make the tie on the back side of the resistor plate so it won't interfere with the sliding contact—then smooth down the front side and your job is just about done. All you have to do now is wash it with carbon—tet or alchohol and put it back together at the same time rapidly patting yourself on the back.

Acq # wm 1981-597/55

How's your Harley, Charlie?

WE'RE talking about your Harley-Davidson Model W.L.C. motorcycle to be exact.

Are you as happy in the saddle as you were home on the range? Is your m'cycle the smooth, snappy, well mannered iron it ought to be? Step back a pace and look her over—and look up what she's lacking. Then first chance you get (which is right now) do something about it.



1. TIRE HOLDING LUG
   Creeping tires kibosh inner tubes—rip out valve stems. If you don't like hard-to-fix punctures get to know
   Modification Bulletin C-1.
2. SPRING ROD SPACER PLATE
   Without it the spring rod bushing might raise from its seat. It's not a valve—so keep it in place if you want sweet fork action. In case you didn't know, the correct distance between the centres of the holes in the plate should be 3¼". The M.B. says $3\frac{5}{16}$" and that's wrong.
   Modification Bulletin H-1.
3. RIDE CONTROL ADJUSTING WHEEL
   The bulletin says move it to the right hand side. If you haven't done this yet—don't. A snoopopsis of the situation reveals that the throttle control may be changed over to the right handle-bar very shortly—so-o-o-o—skip . . .
   Modification Bulletin H-2.
4. HAND CLUTCH CONTROL CABLE
   All sorts of information in this bulletin. If you want the use of your hand clutch—and on the rough stuff you will—take the necessary steps as called in . . .
   Modification Bulletin J-1.
5. HAND CLUTCH CABLE RETAINING WASHER
   Without this natty washer the nipple gets out of its proper seat when you use the foot control—stops the clutch from freely engaging—wears it out—makes the sarge mad etc. 30 sec's will do the job.
   Modification Bulletin J-2.
6. OIL FILLER PLUG
   "Shorty" won't cause the transmission casting to get cracked if the bike falls on a rock or the wrench wielder had too many wheaties for breakfast. A special washer (spare parts No. D.N.D. 90528) slipped on the plug will prevent it jamming tight—see if it's available now.
   Modification Bulletin K-1.
7. STOP LIGHT AUXILIARY SWITCH
   Changing the switch's position saves it from getting filled with mud, sand and assorted pedestrians thrown up by the rear wheel. No wires to change—just a comfy new position under your saddle.
   Modification Bulletin M-1.
8. CYLINDER BASE NUT WRENCH
   A couple of new angles on the wrench will make all the difference in getting at that hard-to-get-at cylinder base nut. No excuse for passing it up on a check over with this modified job either.
   Modification Bulletin O-1.

☐ OF INTEREST TO WORKSHOPS WHERE UNITS LACK THE NECESSARY FACILITIES.

SUPPLY? WHAT'S 'AT?

FOIDERMORE, who gives a damn? All ya gotta do is rekazition like crazy and hoard da parts away. So what if ya don't need 'em? It's a free country, ain't it? What? I should take care of the parts while they're in stock? Man, I ain't got no time for no foolishness like dat. Besides I could always rekazition new parts when da old ones go bad in storidge. Got plenty of ships, ain't we? Man, you're looking at a joker what's on da ball. Just look at da intelligents in da face. Supply don't bodder me—nuttin' does. Who gives a !x"$! about supply?

DON'T BE A DOPE LIKE THE DOPE ABOVE, GIVE A !x"$! ABOUT SUPPLY, SOLDIER! ALL THE SPARE PARTS WE'VE GOT ARE MADE OF GOLD. TREASURE THEM TAKE CARE OF THEM!

FROM ARMY MOTORS